

Application Number 09/992,980
Amendment dated November 21, 2003
Reply to Office Action dated September 11, 2003

Amendments to the Claims

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims

1. (Currently Amended) A method of forming a metal gate electrode having a silicon layer, a conductive barrier layer and a metal layer, the method comprising the steps of:
forming a metal gate electrode pattern comprised of the silicon layer, the conductive barrier layer and the metal layer; and
performing a selective oxidation process to the metal gate electrode pattern in a hydrogen, vapor H₂O and nitrogen containing gas in a reaction chamber, wherein the nitrogen containing gas is at least one gas selected for the group consisting of nitrogen monoxide, nitrogen oxide, ammonia and combinations thereof, the ambient comprising a non-inert nitrogen containing gas which combines combining with the metal layer to form a metal nitride during the selective oxidation process.

2. (Canceled)

3. (Original) The method according to claim 1, wherein the nitrogen containing gas suppresses oxidation of the conductive barrier layer and the metal layer.

4. (Previously Presented) The method according to claim 1, wherein the nitrogen permeates a metal oxide layer which is formed during the selective oxidation process on a surface of the conductive barrier layer and the metal layer, decreases surface mobility of the metal oxide layer, and prevents formation of nucleation sites of whiskers on the metal oxide

layer.

5. (Canceled)

6. (Canceled)

7. (Canceled)

8. (Canceled)

9. (New) A method of forming a metal gate electrode having a silicon layer, a conductive barrier layer and a metal layer, the method comprising:

forming a metal gate electrode pattern comprised of the silicon layer, the conductive barrier layer and the metal layer; and

performing a selective oxidation of the metal gate electrode pattern in hydrogen, oxygen and a nitrogen containing gas in a reaction chamber, wherein the nitrogen containing gas is at least one gas selected from the group consisting of nitrogen monoxide, nitrogen oxide, ammonia and combinations thereof, the nitrogen containing gas combining with the metal layer to form a metal nitride during the selective oxidation process.

10. (New) The method of claim 9, wherein the hydrogen is in an amount sufficient to form hydrogen-rich vapor H₂O.

11. (New) The method of claim 10, wherein the nitrogen containing gas suppresses oxidation of the conductive barrier layer and the metal layer.

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12. (New) The method of claim 10, wherein the nitrogen permeates a metal oxide layer which is formed during the selective oxidation process on a surface of the conductive barrier layer and the metal layer, decreases surface mobility of the metal oxide layer, and prevents formation of nucleation sites of whiskers on the metal oxide layer.
